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UNITED STATES DEPARTMENT OF AGRICULTURE • Agricultural Marketing Service
Agricultural Research Service

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AGRICULTURAL ECONOMICS RESEARCH

A Journal of Economic and Statistical Research in the
United States Department of Agriculture and Cooperating Agencies

Volume XII JULY 1960 Number 3

Observation and Audit Techniques for Measuring Retail Sales

By Earl E. Houseman and Benjamin Lipstein

Over the last few years several groups have experimented with the use of "observation" techniques for measuring the retail movement of fresh produce during a short period of time—a few days or a week. Some investigators have stated that the observation technique offers unique statistical as well as collection advantages. The present investigation was undertaken to compare the relative efficiency of the observation technique with the standard retail audit method, and to develop an efficient system of using observation techniques for measuring retail sales. This study, involving only apples and pears, was conducted in Philadelphia by Audits and Surveys Company, Inc., under contract with the Agricultural Marketing Service.

THE STANDARD retail auditing method consists of (1) taking an opening inventory of the product at the beginning of the sales period; (2) recording at the end of the period, which may be a week, a month or 2 months, the retailer's purchases of the product for the period audited; (3) taking a closing inventory; and (4) computing sales by means of the standard formula:

Opening Inventory+Purchases−Closing Inventory=Sales

The accuracy of the retail audit method of collecting retail sales data is a function of the accuracy of counting inventories, the care with which the retailer keeps purchase records, and records of returns and spoilage. Loss or omission of purchase records causes an understatement of sales; omission of returns and spoilage results in an excess of sales. At times, a failure in retailer records or an inaccurate inventory can be recognized when the standard equation indicates a negative sale. For example, if the closing inventory is greater than the opening inventory and no purchases are recorded, the record of indicated sales is negative. This is more likely to occur with a nonperishable product that has a high ratio of inventory to sales than with a perishable product such as apples or pears, because purchases are frequent and inventories are only a small fraction of total sales. Aside from the reasonableness of the sales data, there is no unique means for measuring respondent failure.

In addition to sales, the retail audit method provides data on inventories and purchases, information that cannot be derived by the observation method—information that may be important in the analysis of the market.

Observation Method

In the observation method, an interviewer records the quantity and unit price for each sale made during specified hours in specified stores. He can report whether a transaction was a bulk or prepackaged sale and state the physical condition of the merchandise. "Exposure" of the products can be determined by a count of customers passing the counter as well as the number of actual transactions. This provides important and useful information on the number of customers and the size of individual purchases. Note that such factors as condition of the product and number of customers "exposed" are not available from either audit or consumer panels.

The audit method permits ascertaining the price of commodities only during the time of the audit, generally a slow sales period. On the other hand, if observation hours are selected at random, an average price can be computed that is an estimate of the average, either weighted by quantity or unweighted, for all transactions during the week.

Description of the Survey

There were two phases to the study, involving different marketing seasons. The plan followed in the second phase—that is, the second marketing season, October 1956 through April 1957—was the result of findings from the first phase, that is, the work conducted during the first marketing season, October 1955 through April 1956.

A preliminary survey was conducted just prior to the first marketing season. Its purpose was (1) to identify food stores that had fresh produce counters and two or more checkout counters and (2) to obtain information on their annual dollar volume, and when slow, medium, and busy sales periods occur during a week. In this preliminary study, about 650 stores were enumerated. A combined area and list type of sample was used. The sample of observation and audit stores described below was selected from the stores in the preliminary survey having self-service, fresh produce counters, and two or more checkout counters.

Throughout the first marketing season, both audit and observation measurements were taken in each sample store. Each store was audited once a week using standard auditing procedures on Monday, Tuesday, or Wednesday, to provide weekly estimates of sales. During each of the selected observation hours, one hour for each of the sample stores, an enumerator was stationed at the fresh produce counter to record the desired information about all customer purchases of apples and pears, including a count of customers passing the fresh produce counter. These observations were limited to Thursday, Friday, and Saturday.

Two equivalent stratified random samples of 30 stores (samples A and B) were selected from the list of stores enumerated in the preliminary survey. Stores on the list were stratified by dollar volume classes, and the sample was allocated to strata in proportion to number of stores. The sample of hours for observation was a random sample, with stratification by slow, medium, and busy periods and a restriction that only one hour for observation be drawn from each store. Two samples of 30 stores were used rather than a single sample of 60 stores, as one purpose of the study was to provide some information on precision, in a form understandable to persons with no training in statistical methods, by comparing results from the two samples.

Variance of Change

It was evident that the variance of observation estimates would be greater than the variance of audit estimates because the observation technique involves the subsampling of time within stores. That is, the sampling error for the observation estimates was comprised of variation between stores and variation between observation periods within stores, whereas the audit estimates were subject only to variation between stores. However, to make a choice between the two methods, information was needed on the magnitude of the differences in sampling error as well as on costs and other factors. Another question was, What is the optimum length of observation period? Consequently, the observers were instructed to keep separate records for the first and second half-hour of each hour's observation so the efficiency of half-hour and one-hour observation periods could be compared. The question of length of observation period is discussed later in more detail.

The two methods of measuring week-to-week change were compared using ratio estimates of the form $\frac{\Sigma X}{\Sigma Y}$, in which X represents audit or observation data on sales for the current week and Y represents the corresponding sales data for the previous week. For one pair of weeks for each of 4 months, the variance of the ratio was computed for the audit and observation methods. Square roots of the averages of these four variances are presented in table 1. These results are for a sample of 30 stores and a time schedule for taking observations that remains unchanged from week to week.

TABLE 1.—*Standard errors of week-to-week ratios for a sample of 30 stores* [1]

Commodity	Standard error		
	Observation		Audit
	1 hour	½ hour	
All apples	0. 12	0. 15	0. 09
All Eastern apples	. 13		. 09
Eastern Delicious	. 22		. 11
Eastern McIntosh	. 32		. 17
Eastern Stayman	. 33		. 15
All Western apples	. 24		. 20
Western Delicious	. 31		. 23
Pears	. 21	. 25	. 11

[1] This table is a reproduction of table 8 in "Measuring Weekly Changes in the Movement of Apples and Pears, 1955–56 Marketing Season" by Houseman, Hoofnagle, and Mullen—a preliminary report issued in February 1957 by the Agricultural Marketing Service.

From table 1, an important point to be noted is that the difference in efficiency is least for all apples. In general, as the volume of sales decreases, the efficiency of the audit method relative to the observation method tends to increase; this is an important factor to remember when making a choice of methods.

Projection to Total Using the Observation Method

As originally construed, one objective of the study was to measure the effectiveness with which the observation procedure could measure week-to-week changes in sales as compared with the standard auditing procedure. But at the middle of the first marketing season, plans were altered to provide a test of the observation technique for estimating *total* sales of apples and pears. The "A" sample was altered to permit estimates of total sales for a week by selecting observation hours during Monday, Tuesday, and Wednesday as well as during the latter half of the week. The "B" sample was maintained on the old basis, namely, observations during Thursday, Friday, and Saturday.

The redesign of the "A" sample made use of 3 by 3 latin square designs. Individual stores were designated as rows, weeks were designated as columns and slow, medium, and busy periods as "treatments." This 3 by 3 arrangement was repeated 10 times over the sample of 30 stores and extended over a period of 12 weeks. In total, this amounted to 40 latin squares (fig. 1). Furthermore, estimates of variation among observation hours within stores and within slow, medium, and busy periods were obtained by taking an additional observation in each of 3 stores each week, as indicated in figure 1. These 3 additional observations were rotated over all 30 stores during the 12 weeks, February through April. Note that the same latin square design was repeated for each 3-week period of the 12 weeks. Thus, on the 1st, 4th, 7th, and 10th weeks, the same sample hours in each of the stores were included in the sample.

FIGURE 1.—*Diagramatic representation of the redesigned observation sample*

Store No.	Week							
	1	2	3	4	5	6	7	Etc. 12
1	B/B	S	M	B	S	M		
2	S/S	M	B	S	M	B		
3	M/M	B	S	M	B	S		
4	B	S/S	M	B	S	M		
5	S	M/M	B	S	M	B		
6	M	B/B	S	M	B	S		
7	M	B	S/S	M	B	S		
8	B	S	M/M	B	S	M		
9	S	M	B/B	S	M	B		
				B/B	S	M		
				S/S	M	B		
				M/M	B	S		
30								

B=Busy customer activity period.
M=Medium customer activity period.
S=Slow customer activity period.
B/B=Two observations in the same store.

For each week, results from two types of estimators were compared:

(1) An "unbiased" projection, to totals for the 30 stores, of apple and pear sales during the observed hours using the reciprocals of the

sampling rates for the slow, medium, and busy customer activity strata; namely,

$$X'=\sum_{i=1}^{R} W_i \sum_{j=1}^{n_i} X_{ij}$$

in which X'=estimated total sales for the 30 stores,
X_{ij}=sales during jth observation period in the ith customer activity stratum,
W_i=reciprocal of the sampling rate in the ith stratum,
n_i=number of observation hours in ith stratum,
and R=the number of strata.

(2) A ratio estimate, namely, apples sold divided by the customer count during the corresponding hours, multiplied by total number of customers:

$$X''=Y\frac{\sum_i W_i \sum_j X_{ij}}{\sum_i W_i \sum_j Y_{ij}}$$

in which Y_{ij}=customer count observed for the jth observation period in the ith stratum,
and Y=total number of customers. (See text below.)

During the preliminary survey, data on number of customers per week were obtained for each sample store. Y is the total of these numbers of customers for the 30 sample stores. Some "statistical inconsistency" in the ratio estimate was recognized as the sum of Y_{ij} over the population of observation hours in the 30 stores was not necessarily equal to Y, because of time differences and because Y was not a count of customers based on the same procedure that was used to obtain the counts Y_{ij}. However, as current values of ΣY_{ij} summed over the population of observation hours in the 30 stores were not available, the ratio estimator as defined above was the only ratio method of estimation that could be used.

In tables 2 and 3, the "unbiased" and ratio estimates are compared with corresponding estimates from the audit method. Although the ratio estimates, as compared with the unbiased estimates, had the lowest sampling error for estimating total sales and their average deviation from the audit totals was less, the evidence in favor of the ratio estimate as defined above is not conclusive for reasons indicated in the previous paragraph.

Table 2.—*Average percentage deviation of the projected observation estimates from the audit total sales*

Method of estimating	Commodity	
	Apples	Pears
	Percent	*Percent*
Unbiased estimate	33. 3	25. 0
Ratio estimate	12. 6	3. 5

Table 3.—*Average coefficients of variation of the projected observation estimates*

Method of estimating	Commodity	
	Apples	Pears
	Percent	*Percent*
Unbiased estimate	18. 1	21. 3
Ratio estimate	12. 5	16. 1

The results suggest, however, that possibilities of developing a "consistent" ratio estimator should be considered. For example, with information on "checkouts" for the observation hours and corresponding information on "checkouts" by the sample stores for the week, a "consistent" ratio estimator could be developed.

Efficiency of Stratification

The efficiency of stratification as discussed below, refers to the observation method and a single stage sampling plan, the observation periods being the sampling units. That is, the concept is that of a population of sampling units (all possible observation periods) which may be stratified in one of two ways: (1) By slow, medium, or busy sales periods, disregarding the store that any particular sampling unit may belong to, or (2) by size of store, which means that all observation periods within stores of a given size group would constitute a stratum.

Such information is not available for all stores prior to sampling, but it can be obtained by making a preliminary survey using a large sample of the kind used for this study. The analysis assumes that the size of the sample for the prelimi-

TABLE 4.—*Gains resulting from stratification, proportionate allocation*

Commodity	Stratification by	
	Volume	Customer activity
	Percent	*Percent*
Apples	23	33
Pears	16	30

TABLE 5.—*Gains resulting from stratification, optimum allocation*

Commodity	Stratification by	
	Volume	Customer activity
	Percent	*Percent*
Apples	40	58
Pears	24	64

nary survey relative to the size of the operating sample is large. In fact, the stratum sizes were assumed to be known without error. To the extent that this is not true, the efficiency of stratification as stated below is overestimated.

Gains due to stratification were computed for each of 12 weeks for the quantity of apples and pears sold, using the following formula,

$$\frac{\sigma_w^2+\sigma_b^2}{\sigma_w^2}-1$$

in which σ_w^2=within stratum variance,
and σ_b^2=between stratum component of variance

The average gains from stratification are shown in table 4. They are based on proportionate allocation of the sample and pertain to estimates of amounts sold and not week-to-week changes. The effect of stratification would be less for week-to-week changes.

The stratification of observation periods by size of store produced a 23-percent gain in efficiency for apple sales compared with a 16-percent gain for pears. There were three size-of-store strata based on dollar volume:

Under $6,000 per week.
$6,000–$20,000 per week.
Over $20,000 per week.

The gains in efficiency from stratification of the observation periods by slow, medium, and busy customer activity were more pronounced than for the size-of-store criteria. The improvement in sampling efficiency was 33 percent for apples and 30 percent for pears. As in the case of store size, the information used for stratification by customer activity was collected from store managers as part of the preliminary survey.

Gains from optimum allocation of the sample to strata are shown in table 5 for apples and pears, for store size, and for customer activity stratification. Optimum, as compared with proportionate allocation, provides a substantial improvement in efficiency. The gains for optimum allocation by customer activity are approximately 60 percent for both apples and pears compared with gains of about 40 percent for apples and 24 percent for pears when using dollar volume.

A system of stratifying observation periods involving a combination of store size and customer activity should be better than either of the methods described. This would be expected because the rating of hours by customer activity is a "within-store" comparison that does not reflect differences in size of store.

Effect of Length of Observation Time on Sampling Efficiency

As the statistical efficiency of a sample is related to the size of sampling unit, in this case length of observation period, the observation data were recorded separately for the first half-hour and the second half-hour of each observation period. This permitted the estimation of variances of sales for apples and pears by slow, medium, and fast customer activity periods, and for half-hour and 1-hour periods. These estimates, which are summarized in table 6, were derived from the replicated observations in the modified "A" sample. The variances for half-hour and 1-hour periods were then plotted against the length of observation period on a log-log chart and the points joined to provide estimates of the variance for other lengths of observation. The assumption underlying this

Table 6.—*Within-store variances of sales for half-hour and hour periods, by customer activity*

Commodity and customer activity	Length of observation period	
	One hour	One-half hour
Apples:		
Slow	11. 8	8. 1
Medium	32. 0	22. 0
Busy	152. 5	90. 2
Pears:		
Slow	2. 0	1. 7
Medium	3. 5	2. 6
Busy	13. 8	8. 3

Table 7.—*Cost by Length of observation*

Length of observation period	Cost of travel and observation
Hours	*Dollars*
0. 50	3. 80
. 75	4. 15
1. 00	4. 50
1. 50	5. 20
2. 00	5. 90
2. 50	6. 60
3. 00	7. 30

procedure is that the log of the variance is linearly related to the log of the length of observation[1] (size of sampling unit).

To determine the optimum length of observation per dollar, data on certain components of cost are needed also. Within the range of the sample sizes that we anticipated might be used, it appeared that the variable part of the field costs would be adequately approximated as a linear function of the cost of observation and of travel between stores which are described in the next section of this report.

Using the variance and cost functions, optimum sizes of clusters were developed for each of the three customer activity periods. The procedure used was to assume a fixed total dollar cost that was to be expended on the survey operation. Based on the fixed cost of travel and observation, the number of stores that could be visited was then computed for half-hour, hour, hour and a half, 2-hour intervals, and so on. The schedule of costs used is shown in table 7.

From the derived number of stores and the variance read from the plotted lines, the relative sampling error was then computed. The lowest sampling error derived in this way determined the optimum length of observation. Table 8 shows the estimated optimum length of observation for the slow, medium, and busy customer activity periods for apples and pears.

Since this analysis is based on two points for a variance function, the estimates of optimum length are undoubtedly subject to considerable error, especially the estimates that involve a high degree of extrapolation. But as the neighborhood of optimum usually ranges over a wide area, the derived optimum sizes are probably not far from the true optimum.

Cost Analysis

A cost analysis was prepared for the audit and observation operations, exclusive of overhead office costs and supervisory costs, as these are constant elements that do not vary materially with changes in sample size.

It may be noted in table 9 that the average travel cost per observation, $1.84, was 21 cents higher than the average cost of travel for an audit visit. This is reasonable when it is recognized that visits for observation purposes are prescribed in advance. In the case of the audit operation, the auditor can make his rounds in the most convenient and expeditious fashion. The miscellaneous costs per store visit, which averaged 51 cents, represent costs of recopying, correcting, and preparation of forms for mailing, and are approximately the same for both audits and observations. The average cost per observation for 1-hour periods was $1.62. This of course is constant over all sizes of stores since the interviewer must observe for 1 hour irrespective of the volume of traffic in the particular store.

The direct audit costs were analyzed in terms of total dollar sales volume of the store. The smaller stores with an average weekly volume of less than $6,000 cost on the average 95 cents, compared with $1.23 for a larger store with a weekly dollar volume of $20,000 or more. These average cost figures include the cost of interviewer time, less cost of travel and miscellaneous expenses. The average number of minutes for travel, observation, and audit are shown in the adjoining column.

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[1] A number of investigations have found this assumption to be satisfactory. Jessen, R. J., *Statistical Survey for Obtaining Farm Facts*, Iowa Agricultural Experiment Station, Res. Bul. 304 (1942). Mahalanobis, P. C., on Large Scale Sample Surveys, Phil. Trans. Roy. Soc. London (1944).

Test of Design Findings

For the second marketing season or phase of this study, the sample was redesigned in view of the experience and information gained during the first season. As before, a preliminary survey was made. The method consisted of:

(1) Selecting an area sample of the metropolitan area using Sanborn clusters and Business Enumeration Districts.[2]
(2) Enumerating of food stores in these clusters.
(3) Making a comparison of these enumerated food stores with food stores on route lists published by a newspaper.
(4) Eliminating from the area sample those stores that were on the route lists, and
(5) Selecting a sample of food stores from the route lists and from stores remaining in the area sample after step (4).

In the sample for the preliminary survey there were 612 food stores, including those selected from the route list and the ones in the area sample that were not on the route list. Information collected from these stores included:

(1) Whether or not the outlet carried fresh products.
(2) Total dollar volume of sales.
(3) If self service, the number of check out counters.
(4) Opening and closing times and a classification of all hours as slow, medium, or busy periods.
(5) Estimated average weekly customer count.

On the basis of these sample data, and the variances from the previous year's study, the audit and observation samples were redesigned.

Table 8.—*Optimum length of observation time*

Customer activity	Commodity	
	Apples	Pears
	Hours	*Hours*
Busy	0. 75	0. 75
Medium	1. 50	3. 00
Slow	2. 50	5. 50

Table 9.—*Field costs*

	Dollars	Minutes
Average travel cost per observation	1. 84	82
Average travel cost per audit visit	1. 63	73
Average miscellaneous cost per store visit	. 51	23
Average in-store cost per observation	1. 62	72
Average cost per store audit, by weekly dollar volume:		
Under $6,000	. 95	42
$6,000–$10,000	1. 05	47
$10,000–$20,000	1. 06	47
$20,000 or more	1. 23	55

As there was less emphasis on a direct comparison of the audit and observation methods during the second marketing season, both methods were not used in the same stores.

Considering costs and sampling error, the first year's experience suggested use of audits in small stores and observations in large stores. This was because, for large stores as compared with small stores, the cost of an audit relative to an observation was higher and the statistical efficiency of audits relative to observations was less.

Self-service did not occur in stores that had less than $6,000 in total weekly sales. This appeared to be a good boundary for determining the subuniverses of small stores and of supermarkets for which the audit and observation procedures would be used. For the operating sample, 100 stores were selected from the 612 enumerated in the preliminary survey. Fifty-nine of the sample stores were audited and observation procedures were used in 41.

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[2] A Sanborn cluster is a group of retail stores identified on Sanborn maps published by the Sanborn Map Co. The Business Enumeration District was a unit of work developed by the U.S. Bureau of the Census for its 1948 Census of Business. Enumeration districts were used where Sanborn map coverage was not available.

TABLE 10.—*Sample allocation of observation periods*

	Customer activity strata		
	Busy	Medium	Slow
Total number of hours (all 41 stores)	924	608	658
Length of observation period in hours	.75	1.5	2.5
Number of sampling units, N_i	1,232	405	263
σ_i	9.06	3.67	1.94
$N_i\sigma_i$	11,162	1,486	510
Theoretical allocation of sample	34.8	4.6	1.6
Actual allocation of observation periods			
Size of store (dollars per week):			
6,000–10,000	10	1	1
10,000–20,000	7	3	1
20,000–30,000	2	1	1
30,000–40,000	4	1	-------
40,000 or more	6	1	2
Total	29	7	5

After deleting stores in the preliminary survey that did not have fresh produce counters and stratifying by total weekly sales, the sample was allocated to size groups approximately in proportion to the product of the square root of average dollar sales per store in a stratum and the number of stores in that stratum derived from the preliminary survey.

With reference to the selection of observation periods in the 41 observation stores, the previous year's study indicated that appreciable gains in efficiency could be achieved by (1) stratifying the time periods by slow, medium, or busy customer activity, and (2) varying the sampling rates and the length of observation period by the three customer activity strata.

As described in the first part of this article, it was determined that the optimum length of observation period was about three-fourths of an hour for busy periods, 1½ hours for medium periods, and 2½ hours for slow periods.

To approximate an optimum allocation of the observation periods in the 41 stores, the hours reported as busy, medium, or slow were converted to numbers of sampling units by dividing the reported hours by the length of observation period given above. Using average variances derived from the previous year's study, an allocation of 41 observation periods was then determined as shown in table 10. The actual allocation by customer activity strata differs from theoretical because (1) it was thought that the estimates of variance for medium and slow periods might be subject to more error than the estimate for busy periods, as they were further removed from the actual observed cluster size, and (2) the additional observations in these two strata would provide a basis for verifying the estimates of variance.

Since the measurement of week-to-week change in the volume of apple sales was of considerable importance, the sample of audit stores and the observation periods selected from the 41 observation stores were held fixed throughout the second marketing season. Substantial gains in efficiency in measuring change can be achieved by holding the sample fixed from week to week.

Collection Procedure

Audits were conducted in the 59 audit stores on Monday through Wednesday of each week throughout the duration of the study using the standard procedure of recording opening and closing inventories, spoilage, returns, and purchases over the week just past. The weekly sales for each store were then derived from the equation: Opening inventory, plus purchases minus spoilage, minus returns, minus closing inventory, equals sales.

The observation sample was distributed throughout the week from Monday to Saturday. The observer recorded the purchases of apples by varieties and simultaneously recorded the number of customers passing the fresh produce counter during the observation period.

Estimates of Total Apple Sales

An estimate of the total sales of apples in Philadelphia was made each week by preparing separate estimates from the audit and observation samples and adding the results together. For the audit sample, the mathematical formulation of the estimate was as follows:

$$X' = \sum_{i=1}^{R} \frac{M_i}{m_i} \sum_{j=1}^{m_i} X_{ij}$$

in which R=number of audit strata,

M_i=number of stores in the ith stratum, which is estimated from the preliminary survey,

m_i=number of sample stores in the ith stratum,

X_{ij}=apple sales in the jth store of the ith stratum.

In the case of the observation data, an aggregate ratio type of estimate was used:

$$X'' = Y \frac{\sum_{i=1}^{S} \frac{N_i}{n_i} \sum_{j=1}^{n_i} X_{ij}}{\sum_{i=1}^{S} \frac{N_i}{n_i} \sum_{j=1}^{n_i} Y_{ij}}$$

in which Y=estimated total number of customers in all stores in the Metropolitan Market in the subuniverse that was sampled by the observation method,

S=number of observation strata,

N_i=total number of sampling units (possible observation periods) in the ith stratum for the 41 stores (see table 10),

n_i=sample number of sampling units (observation periods),

X_{ij}=observed apple sales for the jth observation in the ith stratum,

Y_{ij}=observed customer count for the jth observation period in the ith stratum.

This formula provides a weighted estimate of apple sales based on the reciprocal of the sampling rates for the sample observation periods, divided by a similarly weighted customer count for the same periods. This ratio was then multiplied by the estimated total number of customers in the observation subuniverse, which was developed from the preliminary survey, to obtain an estimate of total apple sales for the observation subuniverse. The observation and audit estimates combined provided an estimate of the total apple sales through retail stores.

Reliability of Estimates of Totals and Change

Standard errors were computed for estimates of total retail apple sales for four weekly periods. These estimated errors ranged from 3.8 to 7.7 percent of the estimated total sales, the average being 6.3 percent. To estimate the standard error of week-to-week ratios of sales, 7 selected pairs of weeks were used. The estimates ranged from 0.061 to 0.094, the average being 0.074.

Some simplifications or approximations were made in the establishment of a procedure for estimating the standard errors quoted in the previous paragraph. One of these approximations was the collapsing of strata. For example, though eight dollar-volume strata were used in selecting the audit stores, only three were used for computation purposes. Similarly, in the case of the observation sample, three strata were used in selection—busy, medium and slow, but only two—busy and a combined medium and slow strata were used for computational purposes. These simplifications had the effect of overstating the sampling error.

A second approximation was the omission of the error in the expansion factors. The design as outlined above is a double sample. The expansion factors used in the projection formula were determined from the preliminary study and are therefore subject to sampling error. But the error contribution of the strata weights are believed to be small and may compensate for the collapsing of strata in the error computation.

The variance function used in computing these sampling errors was as follows:

$$\text{Var. of } (X'+X'') = \sum_{i=1}^{R} \left(M_i^2 \frac{M_i - m_i}{M_i - 1} \frac{V_i}{m_i} \right) + Y^2 \sum_{i=1}^{S} W_i^2 \frac{1}{n_i} \frac{\bar{X}^2}{\bar{Y}^2} \left(\frac{V_{xi}}{\bar{X}^2} + \frac{V_{yi}}{\bar{Y}^2} - \frac{2 \operatorname{cov} X_i Y_i}{\bar{X}\bar{Y}} \right)$$

in which

R=number of audit strata,

S=number of observation strata,

V_i=variance of audit sales in ith audit stratum,

M_i=number of stores in the ith audit stratum,

m_i=number of sample stores in the ith audit stratum,

n_i=sample number of stores or observation periods in the ith stratum,

Y=estimated total number of customers in the observation subuniverse,

$W_i=\frac{N_i}{\Sigma N_i}$=The relative weight of each observation stratum to the total observation subuniverse,

$\overline{X}$=average observed sales per observation period weighted for the different sampling rates in each observation stratum,

$\overline{Y}$=weighted average customer count corresponding to $\overline{X}$,

V_{xi}=variance of observed sales in ith observation stratum,

V_{yi}=variance of customer counts in ith observation stratum,

cov X_i Y_i=covariance of observation sales and customer counts for ith observation stratum.

Summary

One of the original purposes of this study was to compare the efficiency of the audit and observation techniques. But as either technique may provide some information that cannot be obtained by the other, the choice is more than a matter of comparative statistical efficiency and cost. When the average volume of sales per observation period is low, either because a store is small or because the commodity is a low-volume item, the sampling error for the observation method will be comparatively large. Considering statistical efficiency and cost, the observation method is most feasible in large stores. A combination of the two methods, audit in small stores and observation in large stores, was tried successfully during the second year this project was in effect.

Some variations of the audit and observation methods are discussed briefly in the following article.

Observation Techniques in Store Auditing

By Solomon Dutka and Lester R. Frankel

This paper describes some variations of audit and observation methods that are discussed in the preceding article, "Observation and Audit Techniques for Measuring Retail Sales."

ONE OF THE MAJOR TOOLS used in deriving marketing data at the retail level is the standard retail store audit procedure. Classically, this procedure consists of (1) selecting a representative sample of outlets for auditing, (2) securing their cooperation, (3) taking a physical inventory of the item under study and (4) collecting the purchase invoices maintained by the retailers. The retail sales for the items are then derived by the formula: Opening inventory plus retailer purchases minus closing inventory equals sales for the period.

For a variety of reasons, other procedures for obtaining similar types of information (as well as data not obtainable using the standard procedure) which can be broadly classified as "observation" techniques have been utilized. They include all procedures used in obtaining data on either sales, purchases, or inventories other than through the use of the conventional physical inventory and purchase invoice procedure.

The major reasons for the newer techniques are the limitations of the physical audit mechanism itself, including problems of response error and cost considerations. For example, in the accompanying article, "Observation and Audit Techniques for Measuring Retail Sales," reference is made to the use of the "observation" technique in the measurement of retail sales of apples and pears. In this study, conducted for the U.S. Department of Agriculture, a comparison was made of estimates of retail sales of fresh produce (apples and pears) using the standard audit procedure with similar estimates using the observation technique. In this latter procedure, retail purchases by customers were observed and recorded for time-segment samples within stores.

In comparing the results of the two procedures directly, some of the limitations of the physical audit mechanism were apparent. For one, the physical audit and the observation audit *cannot* measure sales data for the same time period because, in conducting the standard audit, all stores cannot physically be audited at the same time and on the same day at uniform time intervals. Even if a large enough field staff can be mustered, retailers generally prefer auditors to conduct their activities so as to cause a minimum of disturbance to the store's general activities. During peak periods, such as Christmas and Easter, this problem becomes even more acute.

Another factor in these comparisons is that although the observation technique used in this procedure recorded actual sales to consumers, the physical audit measures the movement of goods off the premises, which is assumed to be equal to retailer sales. Thus, the physical audit includes spoilage and returns and transshipment (unless specifically recorded) as retail sales.

For other consumer items, the problem of pilferage is especially acute in certain types of retail outlets amounting to a significant item in their retail profit picture. Here again, the physical audit procedure mechanism is subject to an overstatement of retail sales as compared with the observation procedures. Also, certain types of products, such as pharmaceuticals, do not allow for an accurate physical count of inventory.

Failure to achieve full cooperation in conducting the standard audit procedure can cause significant biases in estimating sales data. Failure on the part of the retailer to retain all invoices during the audit interval or to keep records of returns and transshipments can likewise cause biases. Also, in certain types of establishments, the bulk of the retailer purchasing is done on a cash basis with either no invoice recording or simply a summary bill with no description. Finally, it can be shown that for certain high turnover items where substantial time is involved in actually obtaining complete counts of physical inventories and invoices (such as with soft drinks and frozen foods), an optimum solution taking into account the cost and variance functions might suggest the observation technique.

Some additional types of "observation" techniques that have been used follow:

Inventory depletion.—In an effort to derive retail sales data from among stores that cannot provide full cooperation for the standard audit procedure, a system is utilized wherein counts are made of the retail counter or shelf inventory during a cross section of time periods when the store is open. In effect, the procedure consists of recording the depletion in retail inventory at the counter or shelf between restocking periods as a measure of purchases of these items by consumers. Within the cost limitations, this procedure can be made more efficient statistically by oversampling certain of the hours or days during which the store is busiest. This procedure has been found to be particularly useful for consumer items with fairly high turnover. One qualification of this technique is that, though estimates of retail sales can be obtained, it permits no direct method for obtaining data on retailer purchases from wholesalers or on retailer inventories, which might be important for certain products.

Direct observation of sales.—Another variation of the observation technique is that used in measuring retail sales of apples and pears, as previously referred to. This procedure has particular merit for application to measuring the retail movement of fresh produce wherein it might be physically too difficult to utilize the "inventory depletion technique" or to obtain inventory information using the standard audit procedure.

The purchase invoice technique.—Another variation of the observation technique used to derive estimates of retail sales of certain products is the "purchase invoice technique." It is particularly relevant to items that have a relatively large turnover compared with their inventory at any time. Retailer purchase invoices as estimates of retailer sales can likewise be used for other high-turnover products, such as fresh milk and ice cream. There is a constant flow of deliveries of these products and thus little need for any substantial retail inventory.

Direct measures of sales.—Frequently the problem of partial cooperation has been encountered among retailers in auditing products that have high unit cost. Often retailers will permit the collection of certain types of information but not others. In auditing jewelry and cameras, a variation of the warranty card procedure has been employed with the card being filled out at the retail counter. As each consumer purchase is made, the retailer fills out a form attached to the sales slip, then this form is mailed directly to the surveying company. In effect, this provides a direct measure of the sales of these items without having to take complete inventory and collect purchase invoice data.

In providing clients with estimates of retailer sales of gasoline, the procedure of measuring gallons pumped during the audit interval has been used as a measure of retail sales. This does not require an estimate of the inventory at any time within the pumps themselves.

For certain products, such as ethical drug products, costs of collecting inventory information are prohibitive. In order to measure retail sales of prescription items, a procedure of sampling time segments from the pharmacist's prescription book has been used. By sampling within the audit interval and obtaining a copy of the prescriptions recorded, total estimates of sales of prescription items can be made.

In summary, collection of data on retail sales, purchases, or inventories at the retail level through procedures other than the standard physical audit procedure, one which we have labeled "observation" techniques, came into being because of the specific purposes of the audit, the product class or type to be audited, and cost considerations.

Book Reviews

Economics for Agriculture. Selected Writings of John D. Black. Edited by James Pierce Cavin, with Introductory Essays. Harvard University Press, Cambridge. 719 pages. 1959. $12.

JOHN D. BLACK's impress is indelibly stamped upon agricultural economics. The reason becomes clear in *Economics for Agriculture*, in which one may become well acquainted with the man, his work, and the subject generally.

A biographical portrait by John Kenneth Galbraith in part I is a thoroughly adequate and faithful painting by a true artist. The prose is shaped seriously and purposefully. As has been pointed out, Galbraith is typically more adept at caricature than portraiture. In this instance, however, the unspectacular yet striking features of Professor Black—the Scotch-tinged, patient teacher, dreadful lecturer, sympathetic counselor, and tireless worker—are impressively and respectfully recorded.

Dr. Black as researcher, social scientist, Governmental advisor, and prolific author is brought out in 12 succeeding parts, plus a bibliography of his writings. Each part is introduced by a significant, informative statement that provides the reader with perspective in the phase of agricultural economics under consideration. From one to three relevant excerpts are drawn from Black's publications to illustrate his contributions to the subject. In some parts, Black's influence on the development of the subject matter and related aspects is specifically discussed as further preamble to the excerpts.

From these parts one may obtain, with the aid of authentic Black students and authoritative essayists, a reasonable working knowledge of the topics accurately indicated in the headings: Development of Production Economics in Agriculture (Sherman E. Johnson and Kenneth L. Bachman); Economics of Land Use (Marion Clawson); the Economics of Forestry (William A. Duerr); Labor, Tenure, and Credit (M. R. Benedict); Marketing and Cooperation (Ray C. Bressler, Jr. and Theodore Norman); Prices and Price Analysis (James P. Cavin); Consumption, Food, and Nutrition (Willard W. Cochrane); Population, Food Supply, and Resources (David L. McFarlane); Agriculture in the Economy (Bennett S. White, Jr.); Agricultural Policy (Walter W. Wilcox); Political Science, Economics, and the Public Interest (Charles M. Hardin); and Research Method (Oris V. Wells).

Credit is due the editor for assembling a good sample of the lifetime work of a great generalist into meaningful, distinctive parts with remarkably little overlap. Involved, surely, was a labor of love calling for much patience and tact vis-a-vis the contributing "students."

Cogent remarks punctuate the essays, giving them radiance without humor: cf., when Galbraith observes Black's "superb sense of what isn't known" and "his genius for . . . 'opening up the field';" when Cochrane states, "John D. Black pushed into a field that had been preempted . . . ;" or when Johnson and Bachman say, "He has extended and clarified pertinent theory;" or Bressler says, "Although not ordinarily listed as a marketing publication . . . [*Introduction to Production Economics*] must be viewed as one of the substantial landmarks in [marketing];" or Duerr, in an exceptionally lucid exposition of forestry economics, remarks, "From the vantage point of the area, Black looks inward at the firms and their neighborhoods, and outward at the public program to be directed to them."

As Black emerges in one role after another, one is reminded of James Thurber and the varied lives of Walter Mitty. Suffice it to cite his courageous admonishment of cooperative leadership in 1929; his critical incursion into methods of price analysis (despite admitted lack of expertise); his preeminence in agricultural policy, and his behind-the-scenes manipulations to implement policy through programs; his knowledgeable distinctions between policies and programs; his sparkling disagreement with natural scientists dispensing dismal prospects and dramatic nostrums; his temperate, embracive, but sometimes abrasive, approaches to national and world problems; his optimism for providing a nutritious diet to growing populations; his sense of public welfare and social responsibility; his persistently repeated but not repetitious annual reviews of economic situations; his insemination of a young profession with methodology as well as subject matter.

In keeping with the manner of Black, the book will strike responsive chords and evoke reactions. One occurs to this reviewer, who arrived at Minnesota shortly after Dr. Black's departure when his imprint was still fresh in the minds of the faculty. It is unfortunate that another opportunity was missed to bring out the brilliant contributions of the late George M. Peterson to Black's pioneering and monumental books in production economics.

The book appeared shortly before Dr. Black's death. Though devoid of exaggeration and adulation, it nevertheless adds to the imposing stature of "John D." Since he appreciated realistic art, it doubtless gave him joy and satisfaction—hard-earned, well-deserved. It will lead present and future generations to a heritage soundly wrought, well assayed.

Harry C. Trelogan

Problems and Policies of American Agriculture. Essays assembled and published by Iowa State University Center for Agricultural Adjustment. Iowa State University Press, Ames. 460 pages. 1959. $3.95.

COLLATION WITHOUT CRITIQUE is a service of uncertain worth. The unedited back-to-back assembly of essays on farm policy contained in this book, one of the first major products of the (now renamed) Center for Agricultural and Economic Adjustment at Iowa State University, can be regarded as sumptuous smorgasbord, or as a 25-course banquet. The essays, competently prepared by acknowledged authorities, are individually outstanding. But collectively they far exceed the requirements for an adequate intellectual diet.

The book as published is too long, contains too much repetition, shifts the train of thought too often and too abruptly, and is too vulnerable, by virtue of uncontrolled repetitiveness, to magnification of contemporary biases. Exercise of selectivity, with prudent telescoping and paraphrasing of original text, would have contributed a great deal to the usefulness of this project. Alternatively, an editor's introduction to each essay, providing reorientation and transition, might have been employed. Most helpful of all would have been an interpretive summary.

It is true that each reader is obliged to do some digging that might have been made unnecessary through editing—and this is a serious defect in this book, although the only one. The authors and their subjects are well chosen, and the essays are of uncommonly good quality. The book deserves a wide audience and doubtless will receive one.

If frequency of appearance be the test, the nearest to a consensus among the essayists is the view that excess labor on farms is the essential problem of U.S. agriculture. The excess arises out of technological replacement of labor by capital. Among prescriptions offered, greasing the way for departure of farmers or potential farmers to other employment is most popular.

Confidence in efficacy of labor transfer as a corrective device stands high. Karl Fox even suggests that industrial labor's practice of taking quick recourse in unemployment insurance during any adversity helps to open the door wider for farm-emigrant labor. Only Varden Fuller dissents, and he but mildly. He cautions that speeded-up transfer of labor off farms is more easily advocated than achieved.

Noteworthy is the fact that the 25 essays contain few if any proposals for complete abandonment of agriculture to unmitigated economic forces. At the other extreme, few if any authors ask absolute, syndicalistic control. Most programs fall in middle ground. But this is the only possible generalization relative to production programs. Within it, diversity prevails.

Included in the book are good versions of the usual commentaries on resource allocation, demand development, and similar topics. Unique features also are present. The sociologists have their say, and these, such as Paul Miller and others, say it well. This reviewer was struck by a number of scattered comments, well hidden but worth finding, among them the following:

1. The Baker and Halcrow notes on farm credit, a subject not currently in vogue but vitally related to both vertical integration and rural development.

2. Timmons' reservation that if the Federal Government is going to take agriculture under its wing it may as well avail itself of more powers relative to land institutions than have been used to date.

3. Schultz's comments, as original and unprosaic as any in the book, such as that technology is not manna from heaven but a product of resources employed. He suggests by inference that it is proper for society to decide consciously how many resources are to be devoted to research on technology. This stand impresses this reviewer as more mature than the cliches appearing elsewhere, jealously protective of research, which declare any consideration of the matter to be out of bounds. Also timely is Schultz's remark that increase in value of farm assets in recent years due to inflation, "as distinct from the value productivity otherwise inherent," has been of major importance. (Twenty years of capital gains, it may be observed, make for as much disparity between individuals within agriculture as exists between agriculture and nonagriculture, and reminds of George Warren's wisdom that the era when a farmer starts farming in large measure shapes his chance of financial success.)

4. Heady's indignation that agriculture should be singled out for so much incisive judgment-passing on its productivity and its contribution to welfare. "If all other industries were put under the same degree of empirical scrutiny . . ., equal or larger maladjustments [in them] would be found." Further, "who can prove that squeezing some more middle-aged families out of agriculture, to produce zippers for cigarette packages or bigger fins for autos, will increase national welfare?"

5. In the same vein, Clodius declares his impatience with the oft-recurring fatalism that improved returns to agriculture would do little good because they would only be capitalized into higher land values. He is skeptical that such capitalization is inevitable or necessarily bad, observing that "no particular disasters [have resulted] in the nonagricultural economy where the quasi rents and profits of imperfect competition have presumably been capitalized."

6. Not the least among citations is the refreshing advice to scholars to beware their limitations. Says Charles E. Kellogg, "The 19th-century assumptions that research and education would somehow equip society to find the solutions to its problems did not stand the test."

Classed possibly as merely entertaining, and certainly not objectionable, is a dispute in a setting never before seen by this reviewer, namely, that between co-authors within the confines of their article (Beal and Ogg).

A volume so comprehensive cannot be without a minimum quota of imperfections. One may wonder if John D. Black was engaging in a trick of rhetoric in declaring that "technological change in agriculture" must be accepted without a "surplus situation" and without "control of output." Are the exclusions reconcilable? Far more faulty, though doubtless equally inadvertent, is D. Gale Johnson's misadventure in using interregional comparisons to reach, ostensibly, a generalized national conclusion. He compares 27-year changes by regions in farm income per worker and in farm employment. Since trends in demand and price during those 27 years did not differ much by regions (regrettably, no account was taken of this consideration), changes in income per worker tended to vary inversely with changes in number of workers. Naturally so; each share of any kitty is inversely proportional to the number of sharers. But that is no ground for the proffered conclusion that, nationally, "These results are consistent with the view that factors affecting the supply of labor were probably more important than factors affecting demand in determining changes in the average level of farm income per worker during the period." This reviewer feels that the entire CAA report would have profited by editing, and this section should have been edited out.

Harold F. Breimyer

The Southern States Story: The First 35 years. By W. G. Wysor. Southern States Cooperative, Inc. 231 pages. 1959. Available to agricultural economists and other professional agricultural workers upon request.

IN THIS DAY of big business, big farmer cooperatives are essential. Little farmer cooperatives are an anachronism in dealing with other large economic enterprises.

This volume tells how one of our major farm supply cooperatives has come into being, and describes some of the problems that it has met and conquered during the last 35 years. It is an interesting study in adaptation of an organization to its environment. The Southern States Cooperative was tailormade to meet the social as well as the economic needs of its farmer members.

The story is told by the man who was the leader in the development of this great cooperative enterprise. He literally planted the seed and nourished it with character and capacity until it became a fine growing plant. His close relationship with his subject does not intrude into the telling of the story, which is presented modestly and objectively.

In view of the great confusion that exists with regard to cooperatives today, it is hoped that many who should be better informed will read this story, for it can dispel many fallacies and prejudices.

The author blends history with a description of current operations. He does not give us a detailed year-by-year chronological record of growth. Instead, he presents broad general developments and then indicates how the parts of the organization have grown.

The author also gives us a description of the operations of the Southern States Cooperative as they are carried on today. He lays before us the organization in being and action, and shows its relationships to other enterprises.

The book is a testament by one who believes in the cooperative form of enterprise—one who has demonstrated to himself that it will work. It is filled with the spirit of democracy. It espouses a philosophy of cooperation that does credit to the democratic philosophy of another great Virginian, Thomas Jefferson.

There are many quotable passages. For example, the book ends with this sentence: "The ability of Southern States and other cooperatives to adjust methods, operations, services and policies to meet changing needs and conditions may very well determine whether or not the business of farming will remain free, profitable and under the control of farmers themselves."

The general reader will be particularly interested in the discussion of the tax treatment of farmer cooperatives. This is one of the most lucid explanations of the subject that is available. The problem is not as simple as it appears to those who have not taken the time to give it the study it deserves.

Throughout his study, the author makes it clear that Southern States Cooperative, Inc., and its members have no quarrel with the capitalistic free enterprise system which has achieved for Americans the highest standard of living known in the world. His concern is to show how the cooperative system can make this system work better for the farmer. He maintains, "In a free society such as we have in America, farmers' cooperatives, purchasing farm supplies and marketing farm products, are economic and social instruments which (1) promote and protect the opportunities of the individual, and (2) safeguard our cherished free enterprise system."

The author also deals effectively with the subject of vertical integration in agriculture. Here he maintians that cooperatives are the logical means to organize agricultural production and marketing so as to enable farmers to keep control of their own industry. He writes: "Farmers acting together through Southern States are well on the road to a 'do it ourselves' system of integration controlled by farmers, owned by farmers and operated in their own interest to channel the profits from all segments of the production, processing and marketing where it rightly belongs—to the producers."

Joseph G. Knapp

Business Cycles and Economic Growth. By James S. Duesenberry. McGraw-Hill Book Company. 325 pages. $6.50. 1958.

"ECONOMIC GROWTH," generally measured by increases in real Gross National Product, is the current fad of economics, following the "underdeveloped country" fad of a few years ago, and to be succeeded by who knows what? Why the fields of interest of economic theorists should show this marked cyclical behavior is a problem to which economists have not yet turned in any systematic way. Schumpeter's innovator theory may be the best theoretical explanation, but the changing national environment is almost certainly the underlying factor. Be that as it may, with Duesenberry's book, plus several others of nearly equal merit (notably Fellner, *Trends and Cycles in Economic Activity*), and with the long hearing just completed by the Joint Economic Committee, this boom has probably reached its peak, and the downturn is due soon.

Duesenberry has done a remarkable job in his book. He presents an extremely clear and lucid survey of the models of economic growth based on the dynamic interaction of the accelerator and multiplier, these models flowing from Harrod's pioneering work in *Towards a Dynamic Economics*, published in 1948.

The models attempt to explain the processes that account for secular growth of real demand, potential output, and fluctuation in demand by one unified theory. The values of the multiplier and accelerator can lie in any of four ranges, with results following an injection of autonomous investment into the system, ranging from dampened cycles returning to the income level determined by the simple multiplier to a sustained geometric rate of growth in real income. However, the lowest sustainable growth rate turns out to be very high, on the order of 13 percent per year. As the natural factors of growth (that is, population and productivity increase) will not permit the economy to reach this sustainable rate, upon reaching a ceiling set by these factors, income turns downward violently. The downward movement continues until reversed by autonomous investment, and the cycle repeats itself.

A variant of this approach is that of Alvin Hansen, who believes that the values of the accelerator and multiplier are such that no sustained growth occurs and that the observed cycles are caused by waves of autonomous investment. Duesenberry, while recognizing the essential truth contained in these theories, that is, that there is a dynamic relationship between income and investment, rejects the theories as not covering adequately the general features of the capital-income adjustment process. The instability of these models results from the use of a rigid accelerator coefficient and a consumption function that ignores returns on investment.

The author develops his own "income-generation model," building upon extended discussions of the marginal efficiency of investment (chapter 4), sources of funds and costs of capital (chapter 5), oligopoly and investment (chapter 6), investment in housing (chapter 7), and personal saving and consumption (chapter 8). In its simplest form:

$$Y_t = (A+a)Y_{t-1} + (B+b)K_{t-1} \quad \text{and}$$
$$K_t = AY_{t-1} + [B+(1-k)]K_{t-1}$$

where

Y=Gross National Product
K=Capital stock
a=Marginal propensity to consume out of GNP
b=Coefficient giving changes in consumption from changes in capital stock (through profits on dividends and dividends on consumption)
A=Coefficient representing changes in investment related to income
B=Coefficient representing changes in investment related to capital stock
k=Depreciation rate of capital stock.

Under this simplest of systems, capital stock grows whenever gross investment exceeds depreciation, and income grows whenever investment exceeds Robertsonian savings.[1] To have sustained growth, the rate of growth in Y and K must be the same. The two rates of growth are determined by the ratio of capital stock to income; they will remain constant if that ratio remains constant. So, "income *can* grow steadily if there is a real, positive ratio of capital to income at which the rate of growth of income equals the rate of growth in capital" (p. 204).

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[1] Duesenberry gives contradictory definitions of Robertsonian savings. On page 179, he says that it is "the difference between last period's income and this period's consumption." On page 208, he defines it as "the difference between consumption in period t-1 and income in period t." The first is correct; see *Essays in Monetary Theory*, by D. H. Robertson, Staples Press, 1940, p. 65 ff.

The relationship of the rate of growth in Y to the ratio $\frac{K}{Y}$ is linear—that of K is hyperbolic. There will then be two points at which the above equilibrium condition for sustained growth will be met—one stable with respect to shocks to the system, and one unstable. On figure 1, point A is stable, as a shock which changes the ratio $\frac{K}{Y}$ will tend to be self-correcting, and point B unstable. It is on the basis of an elaborated model of this nature that Duesenberry builds his stimulating analysis of cycles and growth. An example of his generalizations is that until the 1920's, the United States economy fluctuated about point A, since then, about point B. Thus, the great depression of the 1930's differed in kind from previous depressions, and no longer does the economy automatically tend toward a stable equilibrium rate of growth. Instead, it is quite sensitive to shocks.

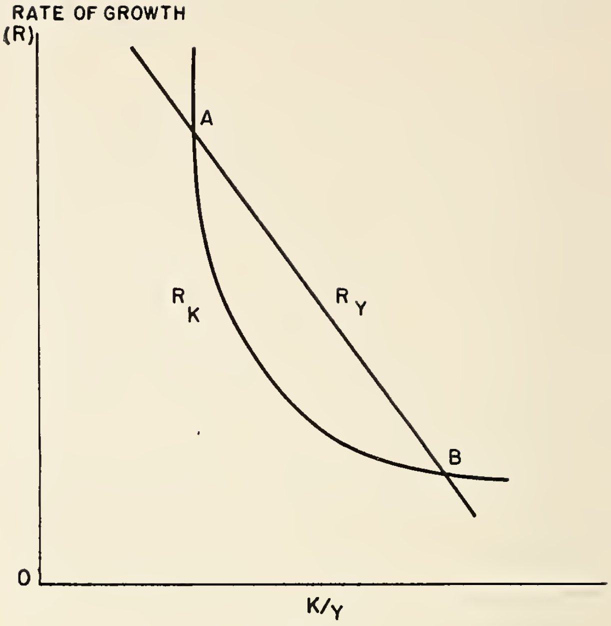

Figure 1.

At best, this review can give only a very small sample of the wisdom and truth contained in Duesenberry's work. The book is must reading for anyone thinking about economic growth and stands as a major work culminating the fad of concentration on economic growth. It is unfortunate that other fads have not been marked by such a monument.

William A. Vogely

Economics of Transportation. By Marvin L. Fair and Ernest W. Williams, Jr. Harper & Brothers, New York. 684 pages. Revised edition, 1959. $8.00.

AMONG THE FEW really good textbooks in the field of transportation economics, Fair and Williams give us one of the best. Most such books are essentially treatises on regulation. Fair and Williams use the functional approach that they introduced in the first edition 10 years ago, and in this revision they bring it up to date.

It is understandable that in earlier decades of this century, when carriage of goods was dominated by regulatory agencies of States and the Federal government, emphasis should be placed upon the history and development of regulatory policy. But in recent years the tremendous growth in private and exempt transportation has exerted the greater influence upon the distribution of resources. Regulation and regulatory policy have not been neglected by Fair and Williams, but they have been relegated to an appropriate position in the economic framework of transportation utility of today.

As an initiation into the intricate maze of facilities, services, and price, which necessarily comprise the greater part of the text, the student will find the opening chapters on transportation as an economic function, its social significance, and its influence upon the national economy, to be most helpful.

Part II lays stress upon the economics of transportation. Here we find exceptionally good chapters on the demand for transportation service and on carrier management and organization. Another chapter relates to cost relationships in carrier service. In particular, the interrelationships between costs by different modes of transport are well handled in this chapter, a difficult matter, considering the divergence between carrier facilities, character of operations, and the financial requirements of different types of carriers.

The book ends with a discussion of national transportation policy and current problems. Mostly these problems concern the difficulties of the railroads, handicapped by the inflexibility of their facilities, operating rules for the protection of labor that were outmoded a generation ago, and rate-making precedents that have outlived their usefulness. The authors point out the ". . . criteria have been employed in promotion and regulation that do not jibe with the expressed objective of an integrated system based on economic fitness. Local policies rather than national economic interest have been all too important in federal-aid policy. In regulative legislation and administration such uneconomic criteria as the following have been employed: (1) Preserving plants of existing carriers, (2) keeping every carrier in operation, (3) preserving existing routes of traffic, (4) preserving existing railroad rate structures, and (5) preserving the jobs of railroad labor. To serve the national interest a policy directive to the Interstate Commerce Commission and other transport agencies requires avoidance of criteria which militate against change and adjustment."

It might be wished that the authors of such a comprehensive study, on the basis of their extensive experience, had pointed out more definitely the direction in which current trends in transportation were leading, or at least that they had indulged in some speculation (which they must have been tempted to do) regarding these trends, and the transportation problems that may need to be faced later on. This would have been helpful to students of transportation as an indication of the challenges to future transportation economists.

J. C. Winter

The Analysis of Variance. By Henry Scheffe. John Wiley and Sons, New York. 477 pages. 1959. $15.

ONE PASSAGE in the preface of this scholarly work gives the prospective reader a good idea of what to expect—"It is well known that one unifying and insightful way of regarding the analysis of variance is from the geometrical viewpoint: it may be viewed as a method of resolving the vector of observations into vectors lying in certain specified spaces corresponding to different sources of variation in the observations, and to each of which a meaningful interpretation can be given. For understanding the geometry of such resolutions and the geometrical interpretations of the statistics used to test whether the magnitudes of some of the component vectors associated with different sources are significant, the concept of orthogonality of vectors and spaces is indispensable. The easiest way of defining, applying, and manipulating this geometric concept is, I believe, through the use of matrix notation."

While a more elementary algebraic treatment would have been possible, the sophisticated approach used here should not frighten the serious student. Once the hurdle of translating matrix notation into elementary algebraic expressions is overcome, the mathematics is not too formidable. There is a wealth of material here that is not available elsewhere in one place. It is perhaps debatable whether a student's first exposure to the subject should be of this kind or whether his indoctrination in fundamental theory should be deferred until he has gained a working knowledge of numerical computations by the cookbook route. This reviewer is inclined to lean toward the latter viewpoint, because many formal proofs and algebraic derivations in the theory become almost self-evident in making computations on experimental data. But regardless of the sequence, the concepts in this book need to be acquired sometime by everyone who really wants to comprehend the subject.

Part I covers the theory of analysis of variance with fixed effects and independent observations of equal variance. The first two chapters are devoted to an excellent résumé of the theory of point estimation and the theory of testing hypotheses as introductory material. The succeeding chapters cover covariance and the various analyses associated with the usual well-known elementary experimental designs. Part II covers analysis of variance with random-effects models, mixed models, randomization models, and effects of departures from underlying assumptions such as nonnormality of data, inequality of variances, and correlations between observations.

This reviewer recommends the book to any practitioner of analysis of variance to whom one or more of these topics sound unfamiliar. Problems to be worked by the student appear at the end of each chapter. A detailed appendix gives an exposition of vector and matrix algebra, and other mathematical material required to understand the text. Tables included are those of F, Studentized Range, and the charts for the power of the F test by Pearson and Hartley and by Fox.

Walter A. Hendricks

Agricultural Economics Research in Asia and the Far East. Study prepared by ECAFE/FAO Agriculture Division. Economic Commission for Asia and the Far East. United Nations and the Food and Agriculture Organization of the United Nations. Columbia University Press. 100 pages. 1959. 75 cents.

ABOUT A THIRD of the report is devoted to an examination of (1) the role of government economic organizations in the collection and analysis of data with a view to facilitating the formulation of agricultural economic policies, and (2) the role of existing organizations in research. The remaining two-thirds of the report gives the status of current agricultural economics research in Burma, China (Taiwan), Federation of Malaya, India, Indonesia, Japan, Southern Korea, Pakistan, Philippines, and Thailand.

The International Age in Agriculture. The Graduate School, United States Department of Agriculture, Washington 25, D.C. 96 pages. $1.75. 1960.

The five lectures given in the Graduate School series on the International Age in Agriculture, together with a summary of seminar discussion that followed the last four lectures, are presented. Topics and speakers are: “Food for Peace,” by Don Paarlberg, Special Assistant to the President; “Technical Assistance Programs in Agriculture, International and Regional,” by Norman C. Wright, Deputy Director-General, FAO; “World Agricultural Market Opportunities and Limitations,” by Max Myers, Administrator, Foreign Agricultural Service, USDA; “Agricultural and Assistance Programs of Other Countries, Including Sino-Soviet Block Countries,” by Thomas C. Mann, Assistant Secretary, Department of State; “Helping Other Countries Improve Their Agriculture,” D. A. Fitzgerald, Deputy Director for Operations, International Cooperation Administration.

Selected Recent Research Publications in Agricultural Economics Issued by the United States Department of Agriculture and Cooperatively by the State Colleges[1]

ANDERSON, K. E., AND HOOFNAGLE, W. S. THE MARKET FOR FOOD IN PUBLIC SCHOOLS. U.S. Dept. Agr. Mktg. Res. Rpt. 377, 58 pp., illus. Jan. 1960.

About 85 percent of total value of food used in schools was acquired through commercial channels in nearby markets. Almost a third of the school food dollar was spent for fluid whole milk. Enough milk was distributed during the year to provide each child with 154 half-pints. Ground beef was one of the most popular items in the menu.

BOUMA, JOHN C., AND KRIESBERG, MARTIN. MEASURES OF OPERATING EFFICIENCY IN WHOLESALE FOOD WAREHOUSES. U.S. Dept. Agr. Mktg. Res. Rpt. 399, 32 pp., illus. May 1960.

Report explains methods for determining and recording how efficiently warehouse space is used, rate of filling retailers' orders, number of errors made, amount of goods damaged in handling, and similar factors. Ways of computing possible savings from use of additional materials-handling equipment also are explained.

BRENSIKE, V. J., AND VOSLOSH, C. J., JR. PRICE SPREADS FOR FORMULATED POULTRY FEEDS IN ILLINOIS. U.S. Dept. Agr. Mktg. Res. Rpt. 378, 19 pp., illus.

Farmer's share of retail price of formulated poultry feeds in Illinois has remained at about 50 percent since 1953. Costs have risen for manufacturers and retailers of formula feeds, though retail prices have declined. Farm prices of ingredients used in these feeds have also declined. More high-energy feeds, with larger proportions of grain, have helped to keep the farmer's share of the retail price stable.

BURNS, DAVID J. MARKETING NEW JERSEY FRESH VEGETABLES. PART II. PRACTICES, PROBLEMS AND RECOMMENDATIONS. New Jersey Agr. Expt. Sta. A.E. 238, 30 pp. February 1960. (Agr. Mktg. Serv. cooperating.)

With favorable economic conditions, demand for fresh vegetables will continue to increase with growth in population. This report presents information on how New Jersey growers, with their favorable location in relation to consuming markets, can maintain and possibly increase their share of the market.

CLARKE, D. A., JR., MCALLISTER, C. E., AND AGNEW, D. B. CLASS III MILK IN THE NEW YORK MILKSHED. II—AN ECONOMIC DESCRIPTION OF THE MANUFACTURED DAIRY PRODUCTS INDUSTRY. U.S. Dept. Agr. Mktg. Res. Rpt. 396, 28 pp., illus. April 1960.

Describes operations of milk manufacturing plants in the New York-New Jersey milkshed. Nearly 40 percent of milk receipts during 1958 were used for purposes other than fluid milk or cream. Disposing of these class III supplies is difficult because flow of milk varies throughout the year. For the market as a whole, 2.5 times more milk is available for manufacture in May than in November.

COLEMAN, W J. STATE-COUNTY-LOCAL COOPERATION UNDER DELAWARE DRAINAGE LAWS. U.S. Agr. Res. Serv. ARS 43-98, 40 pp. Dec. 1959.

Until the late 1930's, State laws pertaining to drainage financing and operations, with minor exceptions, limited responsibility to local organizations. Then the Federal Government in its Civilian Conservation Corps and Soil Conservation Service program, and the State recognized that providing technical and financial services to landowners and drainage organizations resulted in a public benefit. As a result, drainage organizations and landowners have received substantial technical and financial aid. For more than a decade, the State and county have appropriated funds to match expenditures of local organizations for construction and maintenance of ditches. Contributing to success of this cooperative endeavor is the current law, which apparently affords the local organization powers needed to establish and operate an efficient enterprise.

CONNOR, L. J., LAGRONE, W. F., AND BACK, W. B. FARM AND NONFARM INCOME OF FARM FAMILIES IN WESTERN OKLAHOMA, 1956. Okla. Agr. Expt. Sta. Bul. B-552, 19 pp., illus. Mar. 1960. (Agr. Res. Serv. cooperating.)

Of 40 farm families in 8 western Oklahoma counties, 90 percent reported some off-farm income. The average cash income per family was $3,783. Of this, net farm income was $2,105; gross off-farm work income, $978; and other off-farm sources of income, $700. About 44 percent of the cash income of these farm families was from off-farm work.

COWHIG, J. D., AND MAITLAND, S. T. AN ANALYSIS OF THE EXPERIENCED HIRED FARM WORKING FORCE, 1948–1957. U.S. Dept. Agr. Inform. Bul. 225, 19 pp. April 1960.

Over 7 million persons were employed as hired farm workers at some time during a recent 10-year period. This number represented about 6 percent of the U.S. labor force in February 1958 when information was obtained. Over half of these persons had done farm wage work in 1957, the latest year covered by the survey.

DALLAVALLE, Q. F. FARM INVESTMENTS OF LIFE INSURANCE COMPANIES—1959. U.S. Agr. Res. Serv. ARS 43-119, 18 pp., illus. Apr. 1960.

Farm mortgages owned by life insurance companies on January 1, 1959, amounted to $2,661 million, $82 million more than on January 1, 1958. Although this was only 2.47 percent of the total assets owned by life insurance companies, it represented 23.6 percent of the outstanding mortgage debt—the largest share held by any other institutional lender.

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[1] State publications may be obtained from the issuing agencies of the respective States.

Dietrich, R. A., and Williams, W. F. SEASONALITY OF CALIFORNIA AND ARIZONA CATTLE FEEDLOT OPERATIONS. U.S. Dept. Agr. AMS–384, 19 pp., illus. May 1960.

Feedlot operators in these States place relatively large numbers of cattle on feed in early summer and fall and market finished cattle principally during late fall and winter. Changes were apparent in the seasonal pattern of cattle moving to feedlots, but no pronounced shifts were seen in the seasonality of cattle on feed or of marketings from feedlots.

Doughty, H. N. EVALUATING SOYBEANS BY DIELECTRIC ANALYSIS AND OTHER METHODS. U.S. Dept. Agr. Mktg. Res. Rept. 367, 36 pp., illus. Oct. 1959.

An electronic device for quickly measuring the oil content of soybeans has been tested commercially and is reasonably successful, but needs further refinements before it is put into general use. Improvements now being developed may make it possible to pay producers on the basis of the oil content of the beans. New device now measures the oil content as accurately as the content can be estimated by the usual grading practices.

Durost, D. D., and Barton, G. T. CHANGING SOURCES OF FARM OUTPUT. U.S. Dept. Agr. Prod. Res. Rept. 36, 57 pp., illus. Feb. 1960.

Major source of increase in farm output from the Civil War to the end of World War I was an increase in the cropland base. Between World Wars I and II, the increase was due largely to the direct substitution of mechanical power for animal power. From World War II to 1955, the greater farm output resulted chiefly from technological improvement, which increased production both per acre and per animal.

Eisgruber, L. M., and Janssen, M. R. CHANGES IN FARM ORGANIZATION AND OPERATION IN A CENTRAL INDIANA TOWNSHIP—1910 TO 1955. Ind. (Purdue) Agr. Expt. Sta. Res. Bul. 686, 20 pp., illus. Dec. 1959. (Agr. Res. Serv. cooperating.)

Information about changes in farming in Forest Township, Clinton County, Ind., has been recorded in varying intervals since 1910. Changes in Forest Township are probably typical of changes in central Indiana, particularly in type-of-farming area (5a) in which the township is located. Many of the changes that have occurred in this township have also taken place in varying degrees throughout the rest of Indiana.

Ellis, H., Barlowe, R., and Hill, E. B. INHERITANCE OF FARM PROPERTY IN MICHIGAN. Mich. Agr. Expt. Sta. Special Bul. 388, 30 pp. Rev. Oct. 1959. (Agr. Res. Serv. cooperating.)

Describes the Michigan laws in effect at the end of 1952 that relate to the inheritance of farm property, by descent and by will, and certain related laws. As other States have different laws, this information may not apply to property of Michigan residents, particularly real estate, that is located outside the State. The information is designed to give farm residents a general idea of what may happen to farm real and personal property upon death of the owner.

Faber, Fred L. COMMERCIAL POULTRY SLAUGHTER PLANTS IN THE UNITED STATES. NUMBER, SIZE, LOCATION, AND OUTPUT. U.S. Dept. Agr. AMS–379, 28 pp., illus. April 1960.

Large-scale plants processed more than half the commercial poultry slaughter in 1957 though they accounted for only one plant out of five. Small plants processed only 8 percent of the output. Number of plants has been declining in the older egg-production areas, and new plants with large slaughtering capacities have been built in commercial poultry-meat production areas. Medium-sized plants handled 40 percent of the output.

Fisher, L. K., Burkholder, R., and Muehlbeier, J. THE FARM REAL ESTATE MARKET IN NEBRASKA. Nebr. Agr. Expt. Sta. Bul. SB 456, 22 pp., illus. Mar. 1960. (Agr. Res. Serv. cooperating.)

The land market in Nebraska is mainly a parcel market involving the purchase and sale of tracts of land that are not complete farms. A considerable number of tracts sold were operated as complete farms prior to the sale but were incorporated into existing farms by the purchasers, reflecting a trend toward larger farms. By increasing the number of acres operated, a farmer may be able to reduce cost per unit of production by increased scale of operations and fuller use of previously underemployed resources. Thus farm incomes may be increased.

Frye, R. E., and Grubbs, V. D. PROMOTION OF FARM PRODUCTS BY AGRICULTURAL GROUPS. U.S. Dept. Agr. Mktg. Res. Rpt. 380, 27 pp. January 1960.

A survey of agricultural groups during late 1958 and early 1959 showed that slightly over 1,100 of these groups were engaged in promotion. They spent about $67 million during the fiscal year ending in 1958 for the promotion of agricultural products. Besides the $67 million, about $800,000 was spent on foreign promotional activities. About $1.4 million was spent on research related to promotion.

Garlock, F. L., Hamlin, E. T., Taylor, C. C., and Burch, T. A. FINANCING DEVELOPMENT OF SMALL GRADE A DAIRY FARMS IN PIEDMONT AREA, SOUTH CAROLINA. S.C. Agr. Expt. Sta. Bul. 482, 35 pp. Apr. 1960.

Two factors seem to have been associated with the rate at which 39 sample farmers in the Piedmont area of South Carolina who established small grade A dairy enterprises after World War II increased their net worth. One was the time at which the adjustment to grade A milk production was started. Farmers who started the adjustment in 1947–50 had the greatest gains in net worth during the first 3 years of adjustment. Those who started in 1950 and 1951 made the smallest gains. The second factor was the amount of off-farm income that the farmers had during the period of adjustment. Farmers who had no off-farm income made the most rapid progress in developing their dairy enterprises and increasing their net worth. The smallest gains were made by farmers who had substantial amounts of off-farm income.

Gerra, Martin J., and Dexter, Wayne. EGG PRICES . . . AND THE FACTORS THAT INFLUENCE THEM. U.S. Dept. Agr. Mktg. Bul. 5, 11 pp., illus. April 1960.

Presents the more important results of a research study of egg prices and the factors that influence them in nontechnical language to aid producers, marketing agencies, and others engaged in this industry.

Henderson, H. A., and Atkins, S. W. COST AND RETURNS FROM SHEEP IN TENNESSEE. Tenn. Agr. Expt. Sta. Bul. 306, 20 pp., illus. Dec. 1959. (Agr. Res. Serv. cooperating.)

This report deals with a procedure for estimating costs and returns from a 30-ewe flock producing spring lambs under different resource situations. The situations range from no idle resources to shelter and all pasture available at no cost to sheep. For some producers, information on net returns above cash expenses is a useful guide in determining relative returns from different production situations.

Hill, H. L., and Staniforth, S. D. A MODIFICATION OF LEASING ARRANGEMENTS TO EXPAND FARM OPPORTUNITIES. Wis. Agr. Expt. Sta. Res. Bul. 213, 23 pp., illus. Aug. 1959. (Agr. Res. Serv. cooperating.)

Equity and efficiency in leasing arrangements are necessary to avoid transfers of income between tenant and landlord and avoid conflict of interest between landlord and tenant after the lease is drawn up. This must be accomplished by the application of a sound understanding of the principles of equity and consistency in leasing so they can be applied to all individual circumstances and adjust to changing conditions in farming.

Johnson, R. G., and Nodland, T. R. LABOR USED IN CATTLE FEEDING. Minn. Agr. Expt. Sta. Sta. Bul. 451, 16 pp. Mar. 1960. (Agr. Res. Serv. cooperating.)

This bulletin presents labor requirements for feeding cattle according to jobs performed and related to the number fed. It was found that even using hand-feeding methods, large numbers of cattle were more efficient in use of labor than small numbers. Increasing size of small lots, however, gave greater increase in efficiency than that obtained by increasing size of large lots.

Klein, Jack E. MARKETING MILK IN ALASKA. U.S. Dept. Agr. Mktg. Res. Rpt. 385, 29 pp., illus. Mar. 1960.

Analyzes Alaskan milk marketing practices, sources of supply, and types of milk distributed in Alaska. Less than half of the milk drunk in Alaska is fresh milk; a large market exists for other forms of milk, such as recombined, concentrated, evaporated, and dry milk.

Lagrone, W. F., and Connor, L. J. FARM ADJUSTMENT OPPORTUNITIES ON FINE-TEXTURED SOILS OF SOUTHWESTERN OKLAHOMA. Okla. Agr. Expt. Sta. Bul. B-538, 48 pp., illus. Feb. 1960. (Agr. Res. Serv. cooperating.)

Opportunities for farmers to improve income on fine-textured soils in southwestern Oklahoma are limited by relatively low prices for products sold and high prices for items used in production. Opportunities for increasing per acre yields through use of fertilizers and crop rotations are limited. Efforts to increase the permeability of these soils through mechanical means have not been satisfactory, and terracing and contour farming appear to be the most desirable means of controlling erosion and conserving moisture.

Le Ray, N. L., and Rohrer, W. C. EMPLOYMENT OF NEGRO MANPOWER IN CALVERT COUNTY, MD. Md. Agr. Expt. Sta. Bul. 467, 37 pp., illus. Mar. 1960. (Agr. Res. Serv. cooperating.)

Unemployment and underemployment can be decreased in a rural area by adjustments within agriculture, by increased nonfarm employment opportunities in the area, and by movement of individuals to other areas. Effectiveness of any program to increase employment of Negroes in Calvert County will depend upon the degree to which leaders recognize that individual differences exist.

Levine, D. B., and Linstrom, H. R. MANUFACTURERS' OPINIONS OF COTTON AND LEATHER USED IN SHOES. U.S. Dept. Agr. Mktg. Res. Rpt. 392, 69 pp., illus. April 1960.

Cotton is still the fabric used in greatest volume in shoes linings. Almost two-thirds of the shoes manufactured in 1958 contained vamp or forepart linings made of cotton or part cotton. Cotton thread was used in about 85 percent of the shoes, nylon in about 40 percent. Nylon thread is most often used in parts receiving greatest strain, and cotton in other parts. Leather was used for uppers in 85 percent of the shoes.

Lloyd, R. D., and Hecht, R. W. OVERHEAD LABOR ON NORTHERN NEVADA CATTLE RANCHES. Nev. Agr. Expt. Sta. Bul. 209, 32 pp., illus. Sept. 1959. (Agr. Res. Serv. cooperating.)

Ranchers can boost their profits through minimizing overhead costs by (1) using ranch rather than nonranch workers for as many overhead jobs as possible; (2) avoiding use of costly seasonal ranch workers on overhead jobs; (3) doing overhead jobs when crop and livestock labor requirements are low; (4) giving machinery timely and adequate maintenance; (5) overhauling machinery before haying season; (6) timing work on buildings and fences to take advantage of normal ranch labor supply; (7) planning construction of new improvements to make best possible use of available ranch labor; (8) making efficient use of a minimum number of business trips; and (9) using records to improve ranch management.

Looney, Zolon M., and Ghetti, Joseph L. EFFECTS OF TANDEM LINT CLEANING ON BALE VALUES, WEIGHT CHANGES, AND PRICES RECEIVED BY FARMERS. U.S. Dept, Agr. Mktg. Res. Rpt. 397, 20 pp. May 1960.

Use of two or more lint cleaners in tandem at cotton gins raises the grade of much of the cotton, but it also reduces the weight of the bale for which the grower is paid. The net result varies. Some farmers receive more for their twice-cleaned cotton than they would with no lint cleaning or with one cleaning, especially if the quality is low; others receive less. Excessive drying of lint, especially when two or more cleaners are used, raises the grade but is definitely unprofitable to the farmer. Two lint cleaners in tandem reduced the weight of some of the lower grade cotton as much as 30 pounds per bale.

MAGEE, A. C., AND ROGERS, R. H. COMBINING LIVESTOCK WITH CASH CROPS ON BLACKLAND FARMS. Tex. Agr. Expt. Sta. MP–376, 11 pp., illus. Oct. 1959. (Agr. Res. Serv. cooperating.)

Operations on more than 100 farms were studied in the Blackland area in 1957 to learn how farmers have combined livestock with cash crops to increase returns, to use labor fully, and to sell homegrown feeds and forage through meat animals and poultry. Labor and feed requirements and other production costs provide a guide in considering the following enterprises: cow-calf, stocker steer, feedlots steer, sheep, hogs, and laying hens. Average prices received in 1957 were used to develop enterprise budgets for typical farm situations.

MARSCHNER, F. J. BOUNDARIES AND RECORDS. EASTERN TERRITORY OF EARLY SETTLEMENT WITH HISTORICAL NOTES ON THE CADASTER. U.S. Agr. Res. Serv. Rpt., 73 pp., illus. 1960.

Problems of land ownership, land use, and taxation that had to be solved in European countries were similar to those found in the eastern section of early settlement. The unique feature in the evolution of the cadaster is that, although short-cut procedures were at first assayed in these countries in much the same way as we are doing, in the end all of them used essentially the same method of resolving their difficulties. In short, defining and marking boundaries in the field, surveying and measuring the areal components quantitatively and qualitatively, and keeping records of the results obtained is the only reliable method.

MARTIN, ROBERT G., AND HESTER, O. C. MARKETING AND PRICING PUERTO RICAN RAW SUGAR. U.S. Dept. Agr. Mktg. Res. Rpt. 394, 40 pp., illus. April 1960.

Methods of pricing and marketing Puerto Rican sugar have changed substantially in recent years. Selling raw sugar on the basis of average prices for certain periods ranging from a few weeks to a year, rather than on the spot market price on the day of sale, is increasing. Mills are also making more use of the services of operators who buy raw sugar from mills in large quantities and sell it to mainland refiners. Practices followed in the sugar trade from Puerto Rican producer to mainland refiner are described in detail.

METZLER, W. H., AND ARMENTROUT, W. W. FARMING, AND FARM EXPANSION IN FAYETTE, RALEIGH, AND SUMMERS COUNTIES, WEST VIRGINIA, 1958. W. Va. Agr. Expt. Sta. Bul. 439, 12 pp. Dec. 1959. (Agr. Res. Serv. cooperating.)

Results of a survey of 297 farms in the 3-county area indicate that the area has a large amount of labor that is not fully used. They indicate also that a large amount of local capital exists and that there are many residents with managerial experience and ability. What is lacking is a community plan that will use all these resources in a way that will build the economy the area needs and should have.

OWENS, T. R., AND CLARKE, D. A., JR. CLASS III MILK IN THE NEW YORK MILKSHED: III.—COSTS OF MANUFACTURING DAIRY PRODUCTS. U.S. Dept. Agr. Mktg. Res. Rpt. 400, 57 pp., illus. May 1960.

Report gives costs of processing class III milk into selected products at typical plants. Three types of plants were studied: A receiving station, a Cheddar cheese plant, and a plant processing milk into cream and nonfat dry milk. Costs were estimated at 16.6 cents per hundredweight of milk for the receiving station and from 44.8 to 73.5 cents for manufacturing plants. Estimates were based on requirements for buildings, equipment, labor, and other items of expense for processing milk into selected products.

PHILLIPS, RICHARD. COSTS OF PROCURING MANUFACTURING, AND DISTRIBUTING MIXED FEEDS IN THE MIDWEST. CASE STUDY OF FOUR TYPES OF ORGANIZATION. U.S. Dept. Agr. Mktg. Res. Rpt. 388, 76 pp., illus. April 1960.

Costs were slightly lower for independent retailer-manufacturers than for three other systems of manufacturing and distributing mixed feeds. Costs are affected less by the type of organization than by specific factors influencing the cost of ingredients, plant production, and the costs of sales, advertising, and research. Other systems studied were the premix operation with mixing done by dealers, concentrate operation with grain added by dealers, and centralized complete-feed operation through dealers without mixing facilities.

SMITH, E. J. PRODUCING EGGS IN NEW JERSEY. AN ECONOMIC STUDY. U.S. Agr. Res. Serv. ARS 43–113, 20 pp., illus. Feb. 1960.

In trying to improve efficiency and maintain their competitive position, New Jersey poultrymen have made several changes. Among the more important of these are an increase in size of flock, a higher rate of lay per hen, more widespread use of cleaners, graders, and automatic feeders to replace hand labor, and the raising of several lots of replacement birds to permit more efficient use of production facilities and labor throughout the year. Despite these changes, unfavorable cost-price relationships have depressed earnings in recent years.

STALLINGS, D. G. MARKETING DOMESTIC DATES. PACKINGHOUSE PRACTICES AND COSTS. U.S. Dept. Agr. Mktg. Res. Rpt. 373, 19 pp., illus. Nov. 1959.

Chainstores are biggest single outlet for domestic dates, having taken more than half of the 1956–57 sales. Produce wholesalers and specialty wholesalers took 25 percent, and the remaining approximately 25 percent went to general-line grocery wholesalers, independent retailers, bakers, candy-makers, mail order buyers, and retail date shops.

STEWART, C. E. RECENT LAND AND GROUND WATER DEVELOPMENT IN UTAH UNDER THE DESERT LAND ACT. AN ECONOMIC APPRAISAL. Utah Agr. Expt. Sta. Bul. 418, 36 pp., illus. Mar. 1960. (Agr. Res. Serv. cooperating.)

Few family farms were developed in Utah under the Desert Land Act. Only small acreages were cleared and irrigated. Some ventures were successful, and opportunities exist for further success. The magnitude of these opportunities hinges on supplies of ground water. Five areas were selected for detailed study—Grouse Creek, Pavant Valley, River Bed, Skull Valley, and Snake Valley. The desert-land program has been valuable in the study areas from the standpoint of exploring ground-water resources. Much valuable experience and information have been acquired by applicants and Federal agencies for use in future development.

U.S. GOVERNMENT PRINTING OFFICE: 1960

THOMPSON, J. W. LARD MARKETING MARGINS AND COSTS. U.S. Dept. Agr. Mktg. Res. Rpt. 376, 23 pp., illus. Jan. 1960.

Slaughter-to-retail price spread for a pound of lard rose from 7.9 cents in 1949 to 11.2 cents in 1958—an increase of 2.2 cents for retailing and 1.1 cent for wholesaling. From 1949 to 1958 about 66.4 percent of annual lard production was sold directly to consumers for food, 22.7 percent was exported, and about 10 percent was sold to manufacturers of shortening.

THORFINNSON, T. S., SWANSON, N. P., AND EPP, A. W. COST OF DISTRIBUTING IRRIGATION WATER BY THE SPRINKLER METHOD. Nebr. Agr. Expt. Sta. SB 455, 34 pp., illus. Mar. 1960. (Agr. Res. Serv. cooperating.)

Cost of distributing water varied among the 132 farms studied. Many factors were responsible—number of acres irrigated, number of acre-inches of water delivered during the irrigation season, kind of fuel used in the power unit on the well, efficiency of the pumping plant, design of sprinkler system, and extent of irrigation as related to the capacity of the irrigation plant.

VAN DRESS, M. G., AND MYERS, MARDY. EFFECT OF CONSUMER PURCHASES OF NONFAT DRY MILK ON PURCHASES OF FRESH, EVAPORATED, AND FILLED MILK. U.S. Dept. Agr. Mktg. Res. Rpt. 372, 32 pp., illus. Nov. 1959.

Families purchasing nonfat dry milk have a higher total consumption of milk products than families not using nonfat dry milk. Patterns of milk purchases of 477 families in the Chicago metropolitan area were studied over a 3-year period.

WALRATH, A J. IMPACTS OF CHANGES IN LAND USE—A STUDY OF AN URBAN-RURAL AREA OF SOUTHEASTERN WISCONSIN. U.S. Dept. Agr. ARS 43–95, 53 pp., illus. Nov. 1959. (Wis. Agr. Expt. Sta. cooperating.)

This publication is concerned with an area that has been greatly affected by an influx of people into rural communities as a result of new housing developments or other nonagricultural uses of the land.

WHYTE, D. R., SHARP, E. F., LARSON, O. F., AND LERAY, N. L. MIGRATORY FARMWORKERS IN NEW YORK STATE, 1959, AND COMPARISONS WITH 1953, 1957, AND 1958. U.S. Agr. Res. Serv. ARS 43–121, 10 pp. Apr. 1960.

This report summarizes the research findings on (1) changes in the size of the out-of-State seasonal farm labor force in New York State and factors affecting the size of this labor force; (2) changes in the composition of the Negro migratory labor force, 1953 to 1959; (3) composition and employment and earnings of Negro migratory workers, 1953 to 1959; (4) composition, employment, and earnings of Puerto Rican seasonal farmworkers, as reported in 1959 study; (5) employment and earnings in farm and food-processing work within New York State, as found in 1959 study.

WOODS, H. S., AND BUDDEMEIER, W. D. INCREASING PRODUCTION AND EARNINGS ON FARMS WITH BEEF-COW HERDS IN THE UNGLACIATED AREA OF SOUTHERN ILLINOIS. South. Ill. Univ. School Agr. Pub. 6, 40 pp., illus. 1959. (Agr. Res. Serv. cooperating.)

Suggestions for developing high-earning farms on which beef-cow herds are important enterprises are as follows: (1) Increase productive capacity of the soil; (2) adopt recommended soil-erosion control measures and include as much grain as possible in the cropping system; (3) produce hay and pasture crops on land unsuited to frequent cultivation because of topography; (4) increase volume of business to make more complete and efficient use of resources; (5) if capital is limited, use it where return is high and rate of turnover rapid; (6) employ fully the farm labor supply in field crop production, on livestock enterprises that use the grain and roughage crops produced, or on other labor-intensive crop enterprises; (7) know the advantages and limitations of beef-cow herds; (8) follow production practices that will result in high production per cow; and (9) use other livestock in place of, or in conjunction with, a beef-cow herd.

Statistical Compilations

BURKHEAD, C. E., MORGAN, J. J., AND MINOR, E. S. COTTON AND COTTONSEED. PLANTED AND HARVESTED ACRES, YIELD PER ACRE, PRODUCTION, DISPOSITION, PRICE AND VALUE, BY STATES, 1944–58. U.S. Dept. Agr. Statis. Bul. 264, 20 pp. April 1960.

STROHBEHN, R. W., AND WUNDERLICH, G. LAND OWNERSHIP IN THE GREAT PLAINS STATES, 1958. A STATISTICAL SUMMARY. U.S. Dept. Agr. Statis. Bul. 261, 80 pp., illus. Apr. 1960.

U.S. AGRICULTURAL MARKETING SERVICE. CASH RECEIPTS FROM MAJOR FARM COMMODITIES BY STATES, AS PERCENTAGE OF STATE TOTALS, 1924–59. U.S. Dept. Agr. Statis. Bul. 262, 72 pp., illus. April 1960.

AGRICULTURAL ECONOMICS
RESEARCH

Is published quarterly by the Agricultural Marketing Service, U. S. Department of Agriculture. The printing of this publication has been approved by the Bureau of the Budget, Feb. 10, 1959.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 20 cents a single copy, 75 cents a year, domestic, $1 foreign.